



**National Aeronautics
and Space Administration**

**December 20, 1999
NRA 00-OSS-XX**

DRAFT

**NASA Research
Announcement**

**Gossamer Spacecraft Exploratory
Research and Technology**

Notice of Intent Due:
Proposals Due:

OMB Approval No. xxxx-xxxx

Gossamer Spacecraft Exploratory Research and Technology

DRAFT

NASA Research Announcement
Soliciting Basic Research Proposals

NRA 00-OSS-XX
Issued: TBD

Proposals Due: TBD

Office of Space Science
National Aeronautics and Space Administration
Washington, DC 20546-0001

GOSSAMER SPACECRAFT EXPLORATORY RESEARCH AND TECHNOLOGY

Introduction

NASA's Office of Space Science (OSS) issues this NASA Research Announcement (NRA) for Gossamer Spacecraft Exploratory Research and Technology. The Gossamer Spacecraft Initiative will focus on developing revolutionary spacecraft architectures for very large, ultra-lightweight apertures and structures. This NRA solicits proposals for exploratory research to begin long-range development of gossamer spacecraft technology. The overarching goal of the Gossamer Spacecraft Initiative is to achieve breakthrough enhancements in mission capability and reductions in mission cost, primarily through revolutionary advances in structures, materials, optics, and adaptive and multifunctional systems. Gossamer spacecraft technology will enable bold new missions of discovery for NASA such as:

1. Very large telescopes for imaging extra-solar planets, studying the formation of large-scale structure in the early universe, and continuously monitoring the Earth from distant vantage points.
2. Large deployable and inflatable antennas for space-based radio astronomy, high-bandwidth communications from deep space, and Earth remote sensing with radar and radiometers.
3. Solar sails for low-cost propulsion, station-keeping in unstable orbits, and precursor interstellar exploration missions.
4. Large solar power collection and transmission systems for human and robotic exploration missions, and for the commercial development of space.

This NRA is intended to be the first in an annual series of solicitations for gossamer spacecraft technology development. Appendix A contains a detailed description of technical areas for which proposals are solicited. Appendix B provides the standard NASA guidance for responding to NASA Research Announcements. Appendix C provides amendatory guidance to Appendix B for the specific proposal format and submission requirements for this NRA. Note that Appendix C incorporates many formats and/or procedures that are now standard for OSS NRA's. Therefore, interested proposers are advised to read Appendix C in its entirety before writing their proposals. Appendix C includes required certifications and the proposal cover sheet, which must be completed and returned to NASA with any proposal submitted in response to this NRA.

The purpose of this draft NRA is to solicit comments and questions from potential proposers prior to the issuance of the final NRA. Comments on the draft NRA should be submitted electronically or in writing by January 14, 2000 to:

Christopher L. Moore
M. S. 367
NASA Langley Research Center
Hampton, VA 23681
Fax: (757) 864-4449
E-mail: chris.l.moore@larc.nasa.gov

The input from potential proposers will be considered in formulating the final NRA. The final NRA is anticipated for release on February 25, 2000 with approximately eight (8) weeks to submit proposals.

The draft NRA and the final NRA will be available over the Internet. The entirety of this NRA may be found and downloaded in a variety of standard formats by opening "Research Opportunities" from the menu at the OSS homepage on the World Wide Web at URL: <http://spacescience.nasa.gov/>. It is the offeror's responsibility to monitor the forementioned Internet site for the release of the draft NRA and the final NRA and amendments (if any). Potential offerors will be responsible for downloading their own copy of the draft NRA and the final NRA and amendments (if any).

Participation in this program is open to all categories of U.S. and non-U.S. organizations or teams of organizations, including educational institutions, industry, nonprofit institutions, Federally Funded Research and Development Centers (FFRDC), NASA Centers, and other Government agencies. Foreign proposers should be aware that their proposed participation would be on a no-exchange of funds basis in accordance with NASA Federal Acquisition Supplement (NFS) 1872.306. Historically Black Colleges and Universities (HBCU's), other minority educational institutions, and small businesses and organizations owned and controlled by socially and economically disadvantaged individuals or women are particularly encouraged to apply.

Prospective offerors shall provide notice of their intent to submit a proposal by TBD. Proposals may be submitted at any time during the period ending on TBD, but not later than 4:30 PM EST on TBD. Proposals received after that date will be returned unless it is felt to be in NASA's best interests to evaluate the proposal. Proposals will be peer reviewed by approximately TBD. If accepted, they will be integrated into the FY2000 research program beginning approximately TBD.

Special attention is directed to the requirement in Appendix C for electronic submissions to a World Wide Web site of both a Notice of Intent (NOI) to propose and a combined Cover Page/Proposal Summary. Since transmission difficulties may arise anywhere through the Internet, starting at the proposer's institution, at any of its intermediate nodes,

and/or at NASA's receiving sites, proposers are encouraged to submit these items well in advance of their respective due dates to allow for resolution of any difficulties (note: an "edit" function is provided at the Web site to allow changes after the original submissions but before their respective due dates).

OSS policy now strongly encourages participation by the space science and technology communities in education and public outreach activities with the goal of contributing to the broad public understanding of science and technology. Therefore, proposers to this NRA are encouraged to propose an Education/Public Outreach (E/PO) activity as an addition to any proposal submitted in response to this NRA; see the last section in Appendix A for details.

NRA Budget

The following budget information is tentative, and is provided for planning purposes only. Any award will be subject to the availability of funds and appropriate technical evaluation.

The majority of activities under this NRA will consist of two phases. Phase 1 activities will begin exploratory research on a broad range of innovative gossamer spacecraft concepts. The duration of Phase 1 activities is one year. The approximate funding to be awarded for Phase 1 activities in fiscal year 2000 is \$3.5M. It is anticipated that 20 awards will be made for Phase 1 activities.

In Phase 2, the most promising concepts resulting from Phase 1 will be down selected for further development. The duration of Phase 2 activities may range from 1 to 3 years. In fiscal year 2001, \$6M is expected to be available to fund further development of selected Phase 2 activities, and an additional \$2M is expected to be available to fund new Phase 1 activities in a second NRA.

Funds for awards under this NRA are subject to the overall Federal Government and NASA funding process. As always, funding of any task beyond the first year will be dependent upon progress and the availability of funds. The Government's obligation to make awards is contingent upon the availability of appropriated funds from which payment for award purposes can be made and the receipt of proposals, that the Government determines are acceptable for award under this NRA.

Recommendations for funding will be based on the evaluation of each proposal's technical merits, its relevance to the objectives as described in Appendix A of this NRA, and its requested budget. A proposed E/PO activity of merit will be used to discriminate between proposals of otherwise nominally equal scientific, technological, and programmatic merits.

The following summary information applies to this NRA:

- NRA identifier: NRA 00-OSS-XX
- Date of issue: TBD
- Notice of Intent (NOI) to propose:
 - Due date: TBD
 - Address for electronic submission: URL: <http://props.oss.hq.nasa.gov>
Contact dtripp@hq.nasa.gov for assistance.
- Address for electronic submission of proposal *Cover Page/Proposal Summary*:
URL: <http://props.oss.hq.nasa.gov>
Contact dtripp@hq.nasa.gov for assistance.
- Submission of Proposal:
 - Required number: 15 copies plus signed original.
 - Due date by close of business: TBD
 - Address for delivery by U.S. Postal Service, personal courier, or commercial service:

Gossamer Spacecraft Initiative
NRA-00-OSS-XX
Jorge Scientific Corporation
400 Virginia Avenue, SW, Suite 700
Washington DC 20024
Telephone: (202) 554-2775
- Selecting Official:

Director
Advanced Technology and Mission Studies
Division
- Announcement of selections: Goal - 60 days after proposal due date.
- Initiation of funding for new awards: Goal - 30 days after proposal selection.

- Programmatic Point of Contact:

Mr. Richard J. Howard
Gossamer Initiative Program Executive
Code SM
Office of Space Science
National Aeronautics and Space Administration
Washington, DC 20546-0001

Phone: (202) 358-0898

E-mail: rhoward@mail.hq.nasa.gov

- Technical Point of Contact

Dr. Christopher L. Moore
Thrust Area Manager
Ultra-Lightweight Structures and Space Observatories
M. S. 367
NASA Langley Research Center
Hampton, VA 23681

Phone: (757) 864-6073

E-mail: chris.l.moore@larc.nasa.gov

Notice of new electronic notification service for NASA OSS research announcements:

NASA OSS has implemented an electronic notification system for all of its research program announcements. Subscription to this service may be immediately made by selecting the menu item "Get to E-mail Announcements" on the OSS homepage at URL <<http://spacescience.nasa.gov/>>, and then following the instructions within the subsection entitled "Space Science Research Announcements." This electronic service will notify subscribers of all future NASA OSS program announcements regardless of the topic or type of announcement (about 20 per year).

Your interest and cooperation in responding to this NRA are appreciated.

Peter Ulrich
Director
Advanced Technology and Mission Studies Division

Enclosures:

Appendix A, "Technical Description"

Appendix B, "Instructions for Responding to NASA Research Announcements"

Appendix C, " Specific Guidelines for Proposers to this Announcement"

TECHNICAL DESCRIPTION

This NRA solicits proposals for exploratory research to begin long-range development of gossamer spacecraft technology. Gossamer spacecraft technology will enable very large, ultra-lightweight systems for bold new missions of discovery such as:

- Very large telescopes for imaging extra-solar planets, studying the formation of large-scale structure in the early universe, and continuously monitoring the Earth from distant vantage points.
- Large deployable and inflatable antennas for space-based radio astronomy, high-bandwidth communications from deep space, and Earth remote sensing with radar and radiometers.
- Solar sails for low-cost propulsion, station-keeping in unstable orbits, and precursor interstellar exploration missions.
- Large solar power collection and transmission systems for human and robotic exploration missions, and for the commercial development of space.

The overarching goal of gossamer spacecraft technology development is to achieve breakthroughs in mission capability and cost, primarily through revolutionary advances in structures, materials, optics, and adaptive and multifunctional systems.

This NRA will emphasize the following high-priority areas for gossamer spacecraft technology development:

5. Large Apertures
6. Solar Sails
7. Multifunctional and Adaptive Systems
8. Gossamer Spacecraft Systems

Large Apertures

NASA is studying future missions requiring very large space observatories. The long-range goal of the Astronomical Search for Origins and Planetary Systems (ASO) theme in the Space Science Enterprise is to detect and characterize planets in orbit around nearby stars. This grand challenge is a driver of gossamer technology development for large apertures.

Independent of any specific instrument concept, the basic detection physics sets minimum requirements for the optical apertures. Set against the benchmark of the largest ground-based telescopes and the 8-meter Next Generation Space Telescope (NGST), terrestrial planet spectroscopic characterization requires a ten-fold increase in aperture area, and low-resolution direct imaging requires an additional 25-fold increase in area.

Such large collection area requirements most likely preclude implementing missions with only single telescopes. Rather, such missions are currently envisioned to utilize constellations of large telescopes flying in formation and operating as interferometers.

The basic building block for these systems is likely to be diffraction-limited optical collectors of 20-40 meter diameter. One of the critical metrics for such systems is the areal density of the fully loaded primary mirror (optical surface, reaction structure, actuators, and wiring). 100 kg/m² is typical for conventional telescopes, and NGST is striving to achieve between 10 and 15 kg/m². For future ASO missions, areal densities of 1 kg/m² or less are required to enable affordable system architectures. Ultimately, to achieve higher resolution imagery and spectroscopy, even more aggressive architectures with collecting areas equivalent to much larger (100's – 1000's of meters) aperture diameters and much lower areal densities (< 0.1kg/m²) will be required.

Large aperture technologies also have direct applicability to the needs of other NASA missions. For example, the Structure and Evolution of the Universe (SEU) theme needs large apertures for advanced X-ray telescopes, and for radio frequency, microwave, and submillimeter antennas. Space-based radio telescopes, and Earth observing antennas for soil moisture and ocean salinity measurements will need great improvements in antenna technology in the near term. These new antennas will be characterized by sizes exceeding 25 meters in diameter, fraction of a kilogram per square meter areal density, and operating frequencies between 1-100 GHz. Other applications that could benefit from large aperture technology include high-resolution imagers and radar for Earth and Space Science, deep-space communications, and large-scale solar power generation.

Proposals are requested for exploratory research to define advanced concepts for very large gossamer apertures (> 20 meters), to identify key technologies, and to begin development of these technologies in a program culminating in proof-of-concept hardware demonstrations (\geq 1 meter diameter).

Proposed activities may include development and demonstration of concepts for telescopes, antennas, or other large apertures. Areas of specific interest are:

- Concepts to enable very large, ultra-lightweight (areal density \leq 1 kg/m²) optical systems for astronomical telescopes and Earth imagers observing in the sub-millimeter/Far IR, IR, Visible, UV, and X-ray spectral regions.
- Concepts to enable large deployable and/or inflatable antennas for use in space-based radio astronomy, microwave radiometry, radar, and communications.

Desirable performance characteristics for these systems, and for near term proof-of-concept technology and hardware development are:

- (1) High packaging efficiency for small launch volume
- (2) Rapid, low-cost manufacturing
- (3) Design traceable to space-qualified materials
- (4) Robust system response to re-pointing of aperture
- (5) High surface reflectivity after repeated deployment

Proposals for near term development of proof-of-concept hardware are strongly encouraged. Although the visionary program goal is an areal density of 1 kg/m^2 , proposals for proof-of-concept hardware development with an areal density $> 1 \text{ kg/m}^2$ will be considered if they offer a significant potential advantage in performance and rapid, low-cost manufacturing, and if the hardware represents an intermediate step traceable to designs meeting the 1 kg/m^2 goal. Such hardware for diffraction-limited optical performance at visible and IR wavelengths should strive for an immediate areal density goal of $< 5 \text{ kg/m}^2$.

Solar Sails

Solar sails are being considered for several missions planned in the Sun-Earth Connection (SEC) theme, including a Solar Polar Imager, and a first generation Interstellar Probe to be launched within a decade to explore the outer reaches of the solar system. Several missions of the Solar System Exploration (SSE) theme would also be greatly enhanced by the use of solar sails, such as missions to comets and the outer planets. This technology could also enable large sunshields needed to stabilize and protect large gossamer apertures and other cryogenic telescopes.

The main objective is to rapidly advance the readiness of key technologies so that a solar sail space flight experiment can be conducted within the next few years.

Proposals for solar sail technology development are sought in the following areas:

- Innovative designs for solar sails, with emphasis on packageability, areal density, structural stability, deployability, controllability, and scalability to large sails ($> 100 \text{ m}$). Includes concepts for 3-axis stabilized sails, spin-stabilized sails and heliogyros, and sails without support booms.
- Innovative concepts for sail stowage and deployment, including low-volume packaging, launch restraints, deployment methods, and control of deployment dynamics.
- Innovative concepts for using sails not only as a propulsion system, but also to perform other spacecraft functions such as communications, science gathering, and power generation.

- Advanced structural concepts for lightweight deployable and inflatable solar sail support structures with high buckling strength (50-100 meters long).
- Ultra-lightweight ($< 2 \text{ g/m}^2$), high-strength, reflective sail materials with inherent tear resistance. Materials should have operational lifetimes greater than 10 years, and should be resistant to ultraviolet radiation, particle radiation, and extreme temperatures.
- Advanced sail materials concepts such as microporous membranes, microtruss fabrics, biomimetic materials, and materials that sublime when exposed to space.
- Low-cost techniques for fabrication, coating, seaming, and handling of large-area membranes. The research would involve fabricating large membranes to validate proposed manufacturing and assembly processes, and to verify scalability of mechanical, thermal and optical properties.
- Candidate material testing to assess the applicability for sail missions. Includes measurement of critical properties such as strength, modulus, areal density, reflectivity, electrical conductivity, thermal tolerance, toughness, and radiation sensitivity.
- Advanced methods for sail control, including adaptive control algorithms, models of sail dynamics, sail warping, and variable reflectivity materials.
- Testing of candidate materials to assess their applicability for sail missions. Includes measurement of critical properties such as strength, modulus, areal density, reflectivity, emissivity, electrical conductivity, thermal tolerance, toughness, and radiation sensitivity.

Multifunctional and Adaptive Systems

It is expected that both large apertures and solar sails will rely heavily on multifunctional and adaptive systems. To achieve breakthroughs in lowering the cost, launch volume, and mass of future missions it will be necessary to develop highly-integrated multifunctional membranes with embedded thin-film electronics, sensors, actuators, and power sources. Adaptive systems are needed for measuring and correcting surface figure and wavefront errors for large aperture telescopes and antennas, and for controlling structural geometry and dynamics. Proposals are sought for the development of multifunctional and adaptive systems applicable to large, ultra-lightweight deployable or inflatable structures.

Technologies of specific interest are:

- Advanced materials, processes, and models for integrating membranes, electronics, sensors, actuators, MEMS devices, power sources, and their associated interconnects into a unified and adaptable structure.
- Lightweight, distributed power systems, and active or passive thermal control systems integrated with membrane structures. Includes models for optimizing power storage and thermal management designs.

- Materials with controllable surface properties that, when combined with integral control electronics, could adapt to changing environmental conditions or mission needs (e.g., changing optical properties to steer a solar sail).
- Processes for thinning and bonding electronic substrates for attachment to membranes.
- Concepts and components for active, adaptive wavefront control systems, including shape control of membrane mirrors, with correction to < 1 wavelength.

Gossamer Spacecraft Systems

Proposals are sought for development of revolutionary gossamer system concepts, and evaluation of their potential performance in support of Earth Science, Space Science, and Human Exploration and Development of Space (HEDS) missions. These novel concepts should provide either an order of magnitude improvement over existing concepts, or enable missions that were previously considered impossible, while keeping cost and risk within reasonable limits. System concepts can include gossamer elements such as deployable or inflatable structures, multifunctional membranes, tethers, or completely new gossamer technologies. An example concept is a gossamer spacecraft capable of modifying its shape or other functional characteristics so that it can adapt to different mission phases, such as atmospheric entry, descent, landing, and surface exploration.

Proposals should define the system concept, describe its potential benefits for enhancing mission capability and reducing cost, identify enabling technologies, and provide supporting analysis to substantiate system-engineering tradeoffs.

NRA Phases

A majority of activities under this NRA will consist of two phases. Phase 1 activities will begin exploratory research on a broad range of innovative gossamer spacecraft concepts. The duration of Phase 1 activities is one year. In Phase 2, the most promising concepts resulting from Phase 1 will be selected for further development. The duration of Phase 2 activities may range from 1 to 3 years. The objectives for each phase in the two areas of emphasis, large apertures and solar sails, are:

Phase 1. For large apertures, the primary objectives are to begin exploratory research on a broad range of innovative gossamer spacecraft concepts, to identify enabling technologies, and to investigate the basic principles underlying these technologies.

For solar sails, the main objective is to advance the readiness of several key technologies such as materials, structures, deployment, packaging, manufacturing, assembly, testing, and sail control.

Phase 2. In the large apertures area, the most promising concepts resulting from Phase 1 will be awarded additional funding for continued development leading to a proof-of-concept demonstration.

In the solar sails area, the most feasible component technologies will be funded for rapid development.

Proposals to this solicitation should include technical and cost information for both Phase 1 and Phase 2 activities at initial submittal. The Phase 1 information will be considered a firm proposal, while the Phase 2 information, which will be considered preliminary, will be used to understand the overall scope of the proposed effort and will be a factor in the Phase 1 selection. Using the information generated in Phase 1, the Phase 2 proposals may be updated prior to Phase 2 final selection.

Guidelines for Proposals

The following guidelines should be followed by all proposals submitted in response to this NRA:

1. The content of the proposal should provide sufficient detail to enable a reviewer to assess the value of the proposed research, its relationship to the goals of the Gossamer Spacecraft Initiative, and the probability that the investigators will be able to accomplish the stated objectives within the requested resources. The Phase 1 part of the proposal should be limited to 10 double-spaced typewritten pages, without foldouts. The Phase 2 part of the proposal should be limited to the 5 double-spaced typewritten pages. Additional pertinent information including publications, data, etc. should follow the guidelines of Section 5 of Appendix C.
2. Respondents having support from other NASA programs should include clear, concise statements of how their work proposed under this NRA complements and/or extends their current NASA-funded work.
3. All US investigators should include the cost of a single day program review in their budgets for Phase 1. The reviews will be held at the completion of Phase 1, and will take place in the vicinity of Hampton, Virginia, or Pasadena, California. Annual program reviews will be held during Phase 2 to track progress, and their cost should be included in the budgets for Phase 2.

EDUCATION/PUBLIC OUTREACH (E/PO) PROPOSALS

1. Scope of Program

The Office of Space Science (OSS) has developed a comprehensive approach for making education at all levels (with a particular emphasis on K-14 education) and the enhancement of public understanding of space science and/or technology integral parts of all of its missions and research programs. The two key documents that establish the basic policies and guide all OSS Education and Outreach activities are a strategic plan, entitled *Partners in Education: A Strategy for Integrating Education and Public Outreach Into NASA's Space Science Programs* (March 1995), and an implementation plan, entitled *Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy* (October 1996). Both of these documents may be obtained either by selecting *Education and Public Outreach* from the menu on the OSS homepage at [<http://spacescience.nasa.gov/>](http://spacescience.nasa.gov/), or from Dr. Jeffrey Rosendhal, Office of Space Science, Code S, NASA Headquarters, Washington, DC 20546-0001.

In accord with these established OSS policies, proposers to any OSS NRA are strongly encouraged to include an Education/Public Outreach (E/PO) component as part of their research proposal. In addition, anyone holding an existing multiple year research award funded through any previous OSS NRA is encouraged to propose an E/PO supplement to their award (see details in Section 3 below). The following guidelines apply to all proposed E/PO activities:

- An E/PO activity will be funded only in conjunction with an award for a “parent” research proposal;
- The proposed E/PO activity is expected to have a general intellectual linkage to the objectives of its “parent” proposal and/or the expertise of its PI;
- The period of performance of the E/PO activity may not exceed that of its “parent” research award;
- Up to \$10K per year may be proposed for an E/PO program, although larger budgets may be considered if funds permit for a few exceptionally meritorious activities, and for “Institutional” E/PO proposals (see Section 3); and
- NASA requests (but does not require) that the institutional overhead for an E/PO budget be waived by the submitting organization, since in many cases such activities will be of direct value to local educational and/or public science institutions and the budget available for this OSS E/PO program is extremely restricted.

E/PO funding is considered as an add-on over and above any funding guidelines for research proposals that may be given elsewhere in this NRA. E/PO proposals will be evaluated (see criteria below) by appropriately qualified scientific, education, and outreach personnel, and the substance of these reviews will be conveyed to the proposers as part of their debriefings. The OSS Selecting Official will take into account proposed E/PO tasks and their ratings when deciding on final selections and funding levels and as an aid in discriminating between research proposals having otherwise comparable merits.

2. Evaluation Criteria

There are two classes of evaluation criteria against which proposed OSS E/PO activities will be evaluated. The general criteria to be applied to the evaluation of all proposals, which reflect requirements necessary for further consideration of an E/PO proposal, are:

- The quality, scope, and realism of the proposed E/PO program including the adequacy, appropriateness, and realism of the proposed budget;
- The capability and commitment of the proposer and the proposer's team, and the direct involvement of one or more proposal team members in overseeing and carrying out the proposed E/PO program;
- The establishment or continuation of effective partnerships with institutions and/or personnel in the fields of educational and/or public outreach as the basis for and an integral element of the proposed E/PO program; and
- The appropriateness of plans for evaluating the effectiveness and impact of the proposed education/outreach activity.

To ensure that the goals and objectives of the OSS E/PO strategy are realized in practice, proposals will also be evaluated using one or more of the following specific criteria.

Because of the modest financial scope of this program, it is recognized that not all proposals can (or even should) address all of these specific factors. Therefore, only the applicable subset will be considered in evaluating each individual proposal. An educationally sound, well-posed and focused effort that will clearly be effective in reaching its intended target audience is preferable to an unrealistically broad effort. These specific criteria are:

- For proposals dealing directly with or strongly affecting the formal education system (e.g., through teacher workshops or student programs carried out at informal education institutions such as science museums and planetariums), the degree to which the proposed E/PO effort is aligned with and linked to nationally recognized and endorsed education reform efforts and/or reform efforts at the state or local levels;
- The degree to which the proposed E/PO effort contributes to the training, involvement, and broad understanding of underserved and/or underutilized groups in science and technology; and/or
- The potential for the proposed E/PO activity to expand its scope by having an impact beyond the direct beneficiaries, reaching relatively large audiences, being suitable for replication or broad dissemination, or drawing on resources beyond those directly requested in the proposal.

Although creativity and innovation are certainly encouraged, note that neither of these sets of criteria focuses on the originality of the proposed effort. Instead, NASA seeks assurance that the proposer is personally committed to the E/PO effort and that the PI and/or appropriate research team members will be actively involved in carrying out a meaningful, effective, credible, and appropriate E/PO activity; that such an activity has been planned and will be executed; and that the proposed investment of resources will

make a significant contribution towards meeting stated plans and objectives. To aid proposers in the preparation of their proposals, as well as to ensure that reviews are carried out on a consistent basis aligned with the OSS Education Strategy and Implementation Plan, an *Explanatory Guide* to E/PO evaluation criteria has been prepared and may be found by linking through *Education and Public Outreach* at the Web site <<http://spacescience.nasa.gov/>>.

3. Special Case E/PO Proposals

There are three special cases for the submission of E/PO proposals that may be considered by interested participants in OSS programs:

3.1 Submission of the Same E/PO Proposal to Multiple Program Elements within a Single NRA

OSS recognizes that some proposers may submit research proposals to more than one program element offered in a single NRA, or may submit more than one research proposal to the same program element of a single NRA. In either case, it is permissible to submit the same E/PO proposal with all such research proposals subject to three conditions: (i) that OSS will review such an E/PO proposal only the first time it is submitted; (ii) that this one evaluation will carry through to all further submissions of that E/PO proposal for that one NRA; and (iii) that such an E/PO proposal will be funded only once. The Web page that is used for the submission of the E/PO proposal (see Section 5 below) provides for entering information to indicate to OSS that an E/PO proposal has been submitted in conjunction with another research proposal for a given NRA. Note that in such a case, the E/PO proposal must be resubmitted in the identical form as it was the first time; OSS will not separately evaluate E/PO proposals that have only minor changes between such multiple submissions. Substantially different E/PO proposals will, of course, be considered individually.

3.2 “Institutional” E/PO Proposals

Based on recent experience, OSS recognizes that multiple proposers from the same institution who are responding to the same NRA (or single program element within a multiple program NRA) may wish to submit a common, collaborative “Institutional” E/PO proposal. Such proposals should be of larger scope and would be expected to have a larger impact than that possible under the parentage of a single research proposal. Therefore, NASA OSS allows the submission of a common Institutional E/PO proposal involving an arbitrary number of proposers from that one institution subject to the following conditions:

- (iv) The identical E/PO proposal must be submitted in conjunction with every “parent” research proposal submitted from that institution for a single given program element. The Web page that is used for the submission of the E/PO proposal (see Section 5 below) provides for entering information to indicate to OSS that the E/PO proposal is an Institutional Proposal. It must be clearly

marked as an Institutional proposal, identify all the separate research proposals associated with it, identify a team leader for the overall E/PO effort (who may be someone from that institution other than one of the proposing Principal Investigators), and identify all participating personnel.

- (v) Such an Institutional proposal will be reviewed only once by NASA, and a decision whether to fund that proposal (or parts of it--see below) will be made on the basis of that one review.
- (vi) The maximum funding that will be allowed for such an Institutional E/PO proposal is \$7.5K per year for each one of the parent research proposals with which the umbrella E/PO effort is associated.
- (vii) Because not all the parent research proposals associated with a particular Institutional E/PO effort may be accepted, the Institutional proposal must clearly identify how the different elements of the E/PO proposal are related to each other, discuss the consequences of a partial selection (and concomitant funding limitation), and clearly demonstrate the continued viability (including arrangements for leadership of the overall effort) of the proposed program should a partial selection be offered. The page limit for an Institutional E/PO proposal is expanded to five pages (one extra page from that indicated in Section 5 below) to allow discussion of these issues.

3.3 E/PO Proposal as a Supplement to an Existing, Multiple Year OSS NRA Award

The PI of an existing multiple year award selected through any OSS NRA (including this one) having at least one year remaining in its period of performance may submit an E/PO proposal as a supplement to that parent research award. The period of performance for such a supplemental E/PO activity is limited to the balance of the period of performance of the research award. Such a supplemental E/PO proposal should be prepared as a stand-alone package following the format and content guidelines given in Section 5 and submitted in each of two ways:

- (i) as two hard copies submitted with the Progress Report required for the annual funding allotment needed to continue the parent award; and
- (ii) as an electronic submission to the Web site identified in Section 5 below (note: for this option, the Web site will request the information needed to coordinate the E/PO supplement with its parent research award, in particular, the grant or contract number and title of the “parent” award, the names of the NASA program and Program Executive under which that award was first made; and the anniversary date of the parent award).

Such E/PO supplement proposals will be reviewed using the evaluation criteria described above, and, if accepted, the E/PO funding is restricted to start on the anniversary date of the parent award.

4. Assistance for the Preparation of E/PO Proposals

NASA OSS has established a nation-wide infrastructure of space science education/outreach groups whose purpose is to directly aid investigators in identifying and developing high quality E/PO opportunities. This infrastructure provides the coordination, background, and linkages for fostering partnerships between the space

science and/or technology and E/PO communities, and the services needed to establish and maintain a vital national, coordinated, long-term OSS E/PO program. Of particular interest to proposers to this NRA are two elements of this system (which are also described in more detail in the OSS education/outreach implementation plan referred to in Section 1 above):

- Four OSS science theme-oriented E/PO “Forums” to help orchestrate and organize in a comprehensive way the education/outreach aspects of OSS space science and/or technology missions and research programs, and provide both the science/technology and education communities with ready access to relevant E/PO programs and products; and
- Five regional E/PO “Broker/Facilitators” to search out and establish high leverage opportunities, arrange alliances between educators and OSS-supported investigators, and help those investigators turn results from space science and/or technology missions and programs into educationally-appropriate activities suitable for regional and/or national dissemination

Prospective proposers are strongly encouraged to make use of these groups to help identify suitable E/PO opportunities and arrange appropriate alliances. Proposers should be careful to note that these Forums and Broker/Facilitators have been established to provide help, but the responsibility for actually developing the E/PO program and writing the proposal is that of the proposer. Points of contact and addresses for all of these E/PO Forums and Broker/Facilitators may be found by opening *Education and Public Outreach* from the menu of the OSS homepage at <<http://spacescience.nasa.gov> />.

5. Preparation and Submission of an E/PO Proposal

In order to be considered for evaluation, E/PO proposals must adhere to the following formats and also must be submitted both electronically and in hard copy as described below.

- An E/PO proposal is to consist of a contiguous body and budget:
 - The body of the E/PO proposal is limited to four pages ($\leq 17,000$ characters, including spaces, using the fonts and page layouts specified elsewhere in this NRA) and must include the following parts: a brief abstract of the proposed activity (not to exceed 800 characters); an expanded description of the E/PO objectives and planned activities; a description of the intended involvement of the Principal Investigator and/or key proposal team members in the proposed E/PO effort; a description of any educational personnel who are involved in the effort, including proposed partnership institutions (together with specific indicators of commitment on the part of partners where appropriate); a description of how the effort will be managed; and a brief explanation of the requested E/PO budget. Note that the PI or one of the team members of the parent research proposal must have the prime responsibility for overseeing the implementation of the proposed E/PO activity. The responsible individual should be clearly identified in the body of the E/PO proposal.

- The period of performance of an E/PO activity may not exceed that of the parent proposal. The E/PO budget must be summarized for its intended total period of performance, as well as for each individual year thereof, using the format entitled *Budget Summary for Optional Education/Public Outreach Proposal* given at the end of this program element (therefore, an E/PO effort proposed for a three year period of performance will require four budget sheets). In addition, this E/PO budget must be integrated line-for-line into the *Budget Summary* for the entire parent research proposal discussed in Section C.5 and given in Section C.6 of Appendix C of this NRA.

- An E/PO proposal (both body and budget) must be submitted by each of two separate ways:
 - As an electronic submission (for the evaluation process) by uploading it, including its *Budget Summary* sheets, to the secure Web site <<http://cass.jsc.nasa.gov/panel/>>, which provides instructions for this activity using a wide variety of formats. In accordance with the size limits specified above, the peer evaluations will consider only the first 800 characters submitted for the E/PO abstract and 17,000 characters for its body. Proposers without Web access or who experience difficulty in using this site may request assistance from the Lunar and Planetary Institute by E-mail at <panel@lpi.jsc.nasa.gov> or by phone at (281) 486-2136; and
 - As part of the total hard-copy version of the research proposal (see the ordered list of component parts for proposals elsewhere in this NRA); also note that the *Cover Page* for the research proposal must indicate that an E/PO proposal is included by checking the appropriate notification on the form provided on the Web site for its submission.

6. Reporting Activities for Approved E/PO Proposals

In order to assist OSS in obtaining a coherent picture of the entire portfolio of E/PO efforts supported across all OSS programs, the appropriate OSS Education Forum (see section 4 above) will contact proposers whose NRA E/PO components are selected to obtain summary information concerning the nature of and intended audience for their selected E/PO effort. In addition, a brief E/PO progress report will be required in conjunction with the annual progress report required for the continuation of the parent research award. A more complete report will also be required at the completion of the E/PO activity. The Education Forums will supply a simple template for preparation of such reports.

7. Additional Information

Questions about this E/PO program may be directed to:

Dr. David Bohlin
Research Program Management Division
Code SR
Office of Space Science
National Aeronautics and Space Administration
Washington DC 20546-0001
Telephone: (202) 358-0880
E-mail: david.bohlin@hq.nasa.gov

Finally, attention is also called to the Initiative to Develop Education through Astronomy and Space Science (IDEAS) program administered by the Space Telescope Science Institute (STScI) on behalf of OSS. The IDEAS program is open to any space scientist based in the U.S. regardless of whether or not they hold a research grant from NASA OSS. This program, which selects proposals yearly, provides awards of up to \$40K to foster the development of innovative approaches to space science education and outreach by space scientists and their educator partners. The annual solicitation for the IDEAS program is typically released in July with proposals due in October. The annual request for proposals is posted at <<http://opposite.stsci.edu/pubinfo/edugroup/ideas.html>>. Inquiries may be addressed by E-mail to <IDEAS@stsci.edu> or by postal mail to:

IDEAS Program
Office of Public Outreach
Space Telescope Science Institute
3700 San Martin Drive
Baltimore, MD 21218.

BUDGET SUMMARY
for
OPTIONAL EDUCATION/PUBLIC OUTREACH PROPOSAL

(Note: To be integrated with that for the “parent” Research Proposal)

For (check one):

___ **Total Period of Performance from (M/D/Y)** _____ **to** _____
/or/
___ **Year** ___ **of** ___ **from (M/D/Y)** _____ **to** _____

1. Direct Labor (salaries, wages, and fringe benefits) _____
2. Other Direct Costs:
 - a. Subcontracts _____
 - b. Consultants _____
 - c. Equipment _____
 - d. Supplies _____
 - e. Travel _____
 - f. Other _____
3. Facilities and Administrative Costs _____
4. Other Applicable Costs: _____
5. SUBTOTAL--Estimated Costs _____
6. Less Proposed Cost Sharing (if any) _____
7. Carryover Funds (if any)
 - a. Anticipated amount : _____
 - b. Amount used to reduce budget _____
8. Total E/PO Estimated Costs _____

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS
FOR SOLICITED BASIC RESEARCH PROPOSALS

NASA Federal Acquisition Regulations (FAR) Supplement (NFS) Version 89.90
Part 1852.235-72 (January 1997)
(accessible through URL <<http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm>>,
open “Part 1852.228 to 1852.241” from the menu).

(a) General.

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a preaward synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRA's contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRA's.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRA's are subject to the Federal Acquisition Regulation (FAR) and the NASA FAR Supplement (NFS). Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRA's; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b). NRA-Specific Items. Several proposal submission items appear in the NRA itself: the unique NRA identifier, when to submit proposals, where to send proposals, number of copies required, and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c). Proposal Content. The following information is needed to permit consideration in an objective manner. NRA's will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) *Transmittal Letter or Prefatory Material.*

- (i) The legal name and address of the organization and specific division or campus identification, if part of a larger organization;
- (ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;
- (iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;
- (iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;
- (v) Identification of other organizations that are currently evaluating a proposal for the same efforts;
- (vi) Identification of the NRA, by number and title, to which the proposal is responding;
- (vii) Dollar amount requested, desired starting date, and duration of project;
- (viii) Date of submission; and
- (ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization(unless the signature appears on the proposal itself).

(2) *Restriction on Use and Disclosure of Proposal Information.* Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following Notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the Notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the Notice.

Notice

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract(or other agreement) is awarded on the basis of this proposal, the Government shall have the right to use and disclose this information (data) to the extent provided in the contract(or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) *Abstract.* Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) *Project Description.*

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance, relation to the present state of knowledge, and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) *Management Approach.* For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) *Personnel.* The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications, and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) *Facilities and Equipment.*

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non research purposes should be explained.

(8) *Proposed Costs.*

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages, fringe benefits, equipment, expendable materials and supplies, services, domestic and foreign travel, ADP expenses, publication or page charges, consultants, subcontracts, other miscellaneous identifiable direct costs, and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired,

purpose and estimated number and lengths of trips planned, basis for indirect cost computation(including date of most recent negotiation and cognizant agency), and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831(and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(9) *Security*. Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) *Current Support*. For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) *Special Matters*.

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d). Renewal Proposals

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e). Length. Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 10-15 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f). Joint Proposals.

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g). Late Proposals. A proposal or modification received after the date or dates specified in an NRA may be considered if doing so is in the best interests of the Government.

(h). Withdrawal. Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i). Evaluation Factors

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(viii) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j). Evaluation Techniques. Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases, proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k). Selection for Award.

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(l). Cancellation of NRA. NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

SPECIFIC INSTRUCTIONS TO PROPOSERS

1. Introduction1.1 General Provisions and Policies

- *Relationship of Appendices B and C.* The material in Appendix C augments and supplements the material in Appendix B of this NRA. In case of conflict, the material in Appendix C takes precedence.
- *Nominal Period of Performance for Selected Proposals.* Unless otherwise specified in Appendix A, the period of performance for a proposal submitted in response to this NRA is restricted to three years or less. For such multiple year awards, yearly funding allotments are provided only after the submission of an acceptable progress report. The period of performance for an Education/Public Outreach (E/PO) proposal is restricted to that of its “parent” research award (see Appendix A).
- *Unrestricted Freedom to Propose to this NRA.* NASA OSS welcomes proposals in response to this NRA from all qualified proposers. Participation in this program is open to all categories of U.S. and non-U.S. organizations, including educational institutions, industry, nonprofit institutions, NASA Centers, and other Government agencies. Historically Black Colleges and Universities (HBCU’s), other minority educational institutions, and small businesses and organizations owned and controlled by socially and economically disadvantaged individuals or women are particularly encouraged to apply. In accordance with Federal statutes and NASA policy, no eligible applicant shall be excluded from participation in, denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NASA on the grounds of race, color, creed, age, sex, national origin, or disability.
- *Opportunity to Propose Educational/Public Outreach Activities.* Educational/Public Outreach (E/PO) activities are now considered vital and integral parts of all NASA space science and/or technology flight missions and research programs. Therefore, NASA OSS encourages proposers to this NRA to submit an E/PO proposal as a supplement to their research proposal in accordance with the guidelines given in Appendix A. Note that
- originality is not a criterion for such E/PO tasks; rather the important factor is that a tenable task of merit be proposed. Additionally, any Principal Investigator already holding an existing multiple year OSS research award having a period of performance that extends into FY 2000 and that can serve as a “parent proposal” is encouraged to propose an E/PO supplement; guidelines for such an E/PO proposal are also given in Appendix A.

- *Anticipated Level of Competition for Selection.* Regardless of the budgets that are indicated as available in Appendix A, prospective proposers are advised that NASA programs have traditionally been extremely competitive. In the last several years, because of the shortage of resources typically as few as one out of four to five proposals have been selected for funding.
- *Public Access to Data.* As a matter of NASA policy, all data taken or products created in the performance of a NASA research award are considered to be public domain. In addition, NASA may judge that new data or products (including items produced in the pursuit of an Education/Public Outreach proposal) obtained through an investigation selected through this NRA may be of value to the science, technology, and/or education communities at large. If so, NASA reserves the right to direct that such items be deposited in an approved publicly accessible site and, if so, will negotiate appropriate funding to enable such activities (e.g., the reduction and calibration of the data into a format amenable for publicly open archive).
- *NASA-Provided Data and Computational Infrastructure.* OSS provides data and computational infrastructure to support its research community. Information on current science data centers and services can be found on the World Wide Web at <<http://ssds.nasa.gov> >. Any need for high performance computing resources for the proposed research should be explicitly described in the proposal, including the computing system, location, and an estimate of the amount of computing time needed.

NASA high performance computing resources may be made available to successful investigations from facilities at either the Jet Propulsion Laboratory (JPL) and NASA Goddard Space Flight Center (GSFC):

- Resources at JPL include a Cray J-90 system with a peak speed of 24 GFLOP's and a 256 processor Hewlett-Packard Exemplar parallel computer with a peak speed of 184 GFLOP's. For more information, contact Mr. Larry Eversole at (818) 353-2786, or E-mail at <eversole@galaxy.jpl.nasa.gov>.
- High performance computing resources at GSFC include a Cray J-90 system with a peak speed of 19.2 GFLOP's and a 512 processor Cray T3E parallel computer with a peak speed of 305 GFLOP's. More information is available on the World Wide Web at <<http://nccsinfo.gsfc.nasa.gov/NCCS>> and <<http://nccsinfo.gsfc.nasa.gov/ESS>>.
- *Late proposals.* NASA's general policy on late proposals is given in Section (g) of Appendix B and states that such a proposal may be considered only if it is judged to be in the best interests of the Government. Owing to the historically large over-subscription of proposals for NASA's programs, a proposal submitted after the published deadline is unlikely to be considered of uniquely greater value to NASA than the proposals that are submitted on time. Finally, note that processing delays at the proposer's home institution or its method of shipping does not excuse the late submission of a proposal.

1.2 Types of Proposing Institutions

NASA OSS accepts proposals in response to its NRA's from all types of U.S. and non-U.S. institutions (proposals from non-U.S. institutions must adhere to the provision of Section 4 of this Appendix). As an aid to NASA in deciding on the appropriate type of award in the event that the proposal is selected, one of the categories listed below must be indicated at the appropriate line on the proposal's *Cover Page* (see Section 3 of this Appendix):

- *Educational institution* -- A university or two- and four-year college (including a U.S. community college) accredited to confer degrees beyond that of the K-12 grade levels (all such institutions are considered by NASA as nonprofit).
- *Nonprofit, nonacademic organization* -- A private or Government supported research laboratory, university consortium, museum, observatory, or similar organization that supports advanced research but whose principal charter is not for training of students.
- *Commercial organization* -- An organization of any size that operates for profit (fee basis) and with appropriate capabilities and interests to conduct basic research in space sciences and/or technologies.
- *NASA Center* -- All NASA field Centers and the Jet Propulsion Laboratory.
- *Other Federal Agency* -- Any non-NASA, U.S. Federal Executive agency or Federally Funded Research and Development Center (FFRDC) sponsored by a Federal agency.
- *Unaffiliated U.S. resident* -- Any person residing in the U.S., whether a U.S. citizen or resident alien, who has the capabilities and access to facilities for carrying out the proposed project and who, if selected, agrees to fiscal arrangements that, in NASA's opinion, ensures responsible management of appropriated Federal funds.
- *Non-U.S. Organizations* -- Institutions outside the U.S. that propose on the basis of a policy of no exchange of funds; consult Section 4 of this Appendix for specific details.

1.3 Proposal Personnel

Every organization submitting a proposal in response to this NRA must designate a single *Principal Investigator* (PI) who will be responsible for the quality and direction of the entire proposed investigation and for the use of all awarded funds. Note that NASA does not accept the designation of a "Co-Principal Investigator;" there must be only one PI who is solely responsible for an investigation.

NASA strongly encourages proposers to identify only the most critically important personnel to aid in the execution of their proposals. Should such personnel be required, *Co-Investigators* (Co-I's) may be identified who are critical for the successful completion of an investigation through the contribution of unique expertise and/or capabilities, and who serve under the direction of the PI whether or not they receive compensation directly under the award. A Co-I must have a well-defined role in the investigation that must be explicitly defined in the Management section of the proposal (see Section 3 below). In addition, for all proposals submitted in response to this NRA, evidence of the commitment of a Co-I to participate in the proposed investigation is required by way of a brief letter from him/her even if they are from the same institution as that of the PI (see Section 3 below).

There are two informal subcategories of Co-I's that a proposal may identify in its Management section (see Section 3 below), as appropriate:

A Co-I may be designated as the *Task PI* for those cases where the proposing institution does not permit that individual to formally serve as the PI as defined above (e.g., nontenure faculty, research associates, and/or postdoctoral personnel). In such a case, the Task PI will be recognized by NASA to be in charge of the scientific/technical direction of the proposed work, although the formally designated PI is still held responsible for the overall direction of the effort and use of funds.

An *Institutional PI* is a Co-I at an institution other than that of the PI that is making a major contribution to the proposal (e.g., a substantial portion of an experimental investigation) and who serves as the point of contact at the Co-I's institution. (Note: In some cases, NASA may elect to provide an award directly to that Co-I institution with the Institutional PI serving as the "PI" for what otherwise would be a subcontract from the proposing PI institution. However, in this case, the proposal's designated PI is still held responsible by NASA for the overall scientific direction of the proposed effort.)

Finally, proposals may also identify *Collaborators* who are individuals that are less critical to the overall proposal than a Co-I but who are committed to provide a focused though unfunded contribution to a specific task. As for Co-I's noted above, proposals submitted in response to this NRA must include a brief letter of commitment from each Collaborator that describes their specific, intended contribution to the investigation.

1.4 Proposal Evaluation

Although OSS secures scientific and technical evaluations from appropriately qualified peers of the proposers, proposers are expected to provide sufficient detail to enable evaluation by persons who are knowledgeable of but not necessarily specialists in the proposed research. As a general rule, the evaluation criteria in Appendix B, part (i), as amended below, applies to this NRA, although they may be augmented by additional specific factors for each element as provided in Appendix A:

(i) Evaluation Factors.

(1) Unless otherwise specified in the NRA, the principal criteria that apply in evaluating a proposal are its intrinsic merit, its relevance to NASA's objectives, and its cost. The first two criteria will each be weighted approximately twice as heavily as the last criterion.

(2) Evaluation of intrinsic merit includes consideration of the following factors listed in approximate order of decreasing importance:

- The overall scientific and/or technical merit of the proposal and/or unique and innovative methods, approaches, concepts, or advanced technologies demonstrated by the proposal, and the potential impact of the proposed research to its field;
- The qualifications, capabilities, and experience of the proposing Principal Investigator and all other personnel who are proposing to help achieve the proposal's objectives;
- The proposing institution's capabilities, related experience, facilities, techniques, or unique contributions of these that are integral factors for achieving the proposal objectives; and
- The overall standing of the proposal against the known state of the art.

(3) Relevance to NASA's objectives shall mean relevance to the specific objectives and goals given for the Program Element as described in this NRA for which the proposal is submitted, as well as more generally to the NASA OSS science and/or technology themes and goals as defined in the most current OSS strategy documents.

(4) Evaluation of the cost of a proposed effort shall include the realism and reasonableness of the proposed cost, and the comparison of that proposed cost to available funds.

1.5 Proposal Selection and Implementation

Following peer evaluation, the cognizant Program Executive will further review the scientifically and technologically top rated proposals against the programmatic objectives, program balance, and financial resources available for that Program Element. Based on these factors, including judgment of the comparison of the scope and importance of the proposed investigation to its cost, the Program Executive then will present a recommendation for selection to the NASA Selecting Official (identified in this NRA's covering summary letter). The Selecting Official will select for funding those proposals deemed worthy as judged against all of the evaluation criteria and for which financial resources are available. The Selecting Official will also decide on the selection of Education/Public Outreach (E/PO) proposals of merit that are associated with those proposals being considered for selection. An E/PO proposal of merit will be used as an additional factor to discriminate between proposals of otherwise equal merits.

Each proposer will be notified by postal or electronic mail of their selection or nonselection and offered a debriefing to explain that decision. Note that NASA reserves the right to offer selection of only a portion of a proposed investigation; in such a case the proposer will be given the opportunity to accept or decline the offer. Those recommended for selection will be informed of the recommended amount of their award and that their organization will be contacted by a NASA Procurement Office to arrange for an appropriate funding instrument (normally a grant or contract). In all cases, awards are made to the proposing institution, not directly to the proposal's PI. No financial commitment on the part of NASA or the Government may be inferred from any communication, even if in writing, from the NASA Program Executive or Selecting Official. Only a NASA Procurement Office can make financial commitments, obligations, or awards on behalf of the Agency and authorize the expenditure of funds.

2. Notice of Intent to Propose

In order to plan for a timely and efficient peer review process, *Notices of Intent* (NOI's) to propose are earnestly requested by the deadline given in the cover letter for this NRA. NASA understands that the submission of a NOI is not a commitment to submit a proposal, nor is information contained therein considered binding on the submitter. NOI's are to be submitted electronically by entering the requested information through the World Wide Web site identified in the cover letter of this NRA (a point of contact is also provided for anyone without access to the Web or who experiences difficulty in using the specified site). The NOI Web sites will request at least the following information:

- reference to this NRA by its alpha-numeric identifier (this may be included on the Web site template);
- a brief designation of the objectives for which a proposal may be submitted (the Web site may provide a menu from which the appropriate choices may be selected);

- the Principal Investigator's name, physical mailing address, phone number, and E-mail address;
- the name(s) and institution(s) of any Co-Investigator(s) known by the NOI due date;
- a "Yes/No" indication of the intent to submit an E/PO proposal;
- a descriptive title of the intended investigation; and,
- a brief description of the investigation to be proposed.

Additional information may be requested specific to the program description in Appendix A. A separate NOI must be submitted for each intended proposal. Note that this NOI may take the form of being the preliminary version of the proposal *Cover Page/Proposal Summary*; if so, the Web site will provide a password to the user for future use in updating this information for the final *Cover Page/Proposal Summary* as the deadline for submission of the final proposal approaches (see further discussion in Section 3 below).

3. "Renewal" Proposals

Holders of existing research awards frequently propose in response to successive NRA's in the same program area in order to extend an ongoing research activity to its next logical step. However, in order to ensure equitable treatment of all submitted proposals, NASA OSS does not extend any special consideration to such proposals in terms of preferential handling, review, or priority for selection. Therefore, OSS chooses not to formally recognize or use the term "renewal proposal." Instead, all proposals in response to this NRA are considered "new" regardless of their previous history of NASA funding. Nevertheless, such follow-on proposals are welcome and encouraged, and should indicate relevant achievements made during the course of any previously existing award in its *Scientific/Technical/Management Section* (see below in Section 5.3).

To allow their identification and assessment of achievements, the following specific information must be provided by proposers who seek to extend an existing research activity relevant to this NRA and for which NASA funding will expire in the next 12 calendar months: (i) the existing NASA grant or contract number must be entered on the proposal *Cover Page*; and (ii) the *Final Progress Report* for that previous award must be included as part of the proposal (see Section 5.3 below for details). Such follow-on proposals must otherwise fully comply with all guidelines for preparation, content, and submission as outlined in this NRA, and they will be reviewed on an equal basis with all other submitted proposals. If such a proposal is selected, NASA reserves the right to fund the investigation either by amendment of the existing award or by a totally new award. In either case, the starting date of the new award will follow that of the expiration date of the existing award. Note that directions for the submission of the Annual Progress Reports that are necessary for an annual funding allotment may be obtained directly from the relevant Program Executive.

4. Guidelines for International Participation

NASA welcomes proposals from institutions from outside the U.S., as well as proposals from U.S. institutions that include collaboration with Co-Investigators at non-U.S. institutions. In either case, however, investigators working for non-U.S. institutions are not eligible for funding from NASA. Therefore, proposals from non-U.S. institutions should not include a cost plan unless the proposal involves a Co-Investigator working in the U.S., in which case a budget for just that participation must be included. Proposals from non-U.S. institutions, and U.S. proposals that include non-U.S. participation, must be endorsed by the government agency or sponsoring institution in that country from which the non-U.S. participant is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and that, if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

In addition to sending the specified number of copies of the proposal to the address designated in this NRA, one copy of the proposal, along with a Letter of Endorsement from the sponsoring non-U.S. agency, must be forwarded to:

Ms. Wavalene Barnes
NRA 00-OSS-xx
Space Science and Aeronautics Division
Code IS
NASA Headquarters
Washington, DC 20546-0001
USA

All non-U.S. proposals must be typewritten in English and conform to all other standards for format and content specified in this NRA and will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established proposal due date; those received after the closing date will be treated in accordance with NASA's standard policy for late proposals (see Section 1.1 above and Section (g) in Appendix B). The sponsoring non-U.S. agencies may, in exceptional situations, forward a proposal to NASA without endorsement if endorsement is not possible before the announced closing date. In such cases NASA's Space Science and Aeronautics Division should be advised when a decision on endorsement can be expected.

Successful and unsuccessful non-U.S. proposers will be contacted directly by the NASA Research Program Management Division concerning the selection or nonselection for their proposals, and copies of these letters will also be sent to the sponsoring organization. Should a non-U.S. proposal or a U.S. proposal with non-U.S. participation be selected, NASA's Space Science and Aeronautics Division will arrange with the non-U.S. sponsoring organization for the proposed participation on a no-exchange-of-funds

basis, in which NASA and the non-U.S. sponsoring organization will each bear the cost of discharging their respective responsibilities. Depending on the nature and extent of the proposed cooperation, this arrangement will entail a letter of notification by NASA and either an exchange of letters between NASA and the sponsoring organization, or an agency-to-agency Memorandum of Understanding (MOU).

5. Guidelines for Preparation of Proposals

5.1 Standard Default Formats

Unless directed otherwise by the Program Element in Appendix A, the standard, default formats for all proposals submitted in response to this NRA are as follows:

- Typewritten English text using an easily read font having ≤ 15 characters per inch on white, 8.5x11 inch paper (or A4 stock for non-U.S. proposals), in single or double column format with at least one inch (2.5 cm) margins.
- Double-sided printing preferred but not required.
- Bound only with metal staples to facilitate recycling (i.e., no cardboard or plastic covers, or permanent binders), with the original copy bound in a manner that allows easy disassembly should NASA need to make additional copies.
- No fold out pages, colored illustrations, or photographs unless critical for the unique display of important proposal data.
- No material submitted on any type of electronic media, nor reference to sites on the World Wide Web for material needed to complete or review the proposal.
- Use of only metric and standard astronomical and engineering units.
- Strict adherence to the fixed page limits given in Section 5.2 below.

5.2 Checklist For Proposal Preparation and Submission

All proposals are to include the following materials in the order and using the titles as given. Details for each item are given in the same order in Section 2.

PRESUBMISSION ACTIVITIES

____ *Notice of Intent to Propose* - electronically submitted to the World Wide Web site by the date given in the cover letter of this NRA (this Web site will be open for submissions starting on the release date of this NRA).

____ *Cover Page/Proposal Summary* - electronically submitted to the World Wide Web site given in the summary cover letter to this NRA and according to the directions below, and in time to procure original signatures on a printed hard copy as required for submission with the copies of the proposal itself by the deadlines in cover letter (this Web site will be open for submissions approximately 45 days prior to the due date for the proposals themselves).

CONSTITUENT PARTS OF A PROPOSAL (required and optional, in order of assembly)

		<u>Page Limits*</u>
___ <i>Cover Page/Proposal Summary</i>		Per printout from Web
___ <i>Summary of Personnel, Commitments, and Costs</i>		1
___ <i>Scientific/Technical/Management Section</i>		≤10**
___ <i>References</i>		As req'd
___ <i>Facilities And Equipment</i> (as needed and appropriate)		≤ 1
___ <i>Education/Public Outreach (E/PO) Proposal</i> (optional)		≤1
___ <i>E/PO Budget Summary</i>		≤1
___ <i>Curriculum Vitae</i>	for the PI:	≤1
	For each Co-I:	≤1
___ <i>Current and Pending Support</i>		As req'd
___ <i>Statement(s) of Commitments from Co-I's and/or Collaborators</i>		As req'd
___ <i>Research Budget Summary and Details</i>		As req'd
___ <i>Reprints/Preprints</i> (optional; maximum of 2)		N/A

* where each side of a sheet containing text or illustration counts as a page and each "n-page" fold-out counts as n-pages.

** including illustrations, tables, and figures, unless otherwise specified in individual in Appendix A.

SUBMISSION ACTIVITIES

- ___ *Cover Page/Proposal Summary* - print out final and complete version from specified Web site in time to secure the Principal Investigator and Authorizing Institution signatures, and to produce the required number of hard copies to be submitted (originally signed *Cover Page/Proposal Summary* to preface original of proposal).

- ___ Provide for delivery of the specified number of hard copies of the proposal to the correct address by close of the normal business day on the specific Due Date (see the summary cover letter for submission date and the submission address).

- ___ If an E/PO proposal is also included with the parent research proposal, submit the E/PO proposal electronically to the secure Web site specified in the E/PO section of Appendix A.

5.3 Details of Proposal Contents

All proposals in response to this OSS NRA should be assembled with the following parts (note that some are as required or optional) in the order listed. Proposals that omit any of their required parts will be returned without review. The program description in Appendix A may also ask for materials in addition to these items. For convenience, each of the items below is cross-referenced to the corresponding part of Appendix B of this NRA. Note: Several parts of Appendix B are not cited but should also be considered for a complete understanding of all the policies and provisions for proposals solicited through this NRA.

- *Cover Page/Proposal Summary*

All proposals must be prefaced by an integrated *Cover Page/Proposal Summary* that contains important, required information (see below). This item is produced by first entering the requested information electronically through a World Wide Web site identified in the Cover Letter of this NRA and then printing out this form by the proposer.

Note: (i) a point of contact is also identified for any proposer without access to the Web or who experiences difficulty in using the specified site; (ii) a sample of this Web form may be printed out at any time for preliminary inspection; and (iii) the only valid format for submission of this item is through the Web. The printed copy of the electronically submitted form is then used to obtain original signatures of the PI and an official from the proposing institution to submit with the original copy of the proposal. In addition, reproductions of this original *Cover Page/Proposal Summary* are used to preface the required printed copies of the proposal.

Upon accessing the specified Web site, at least the following information for the *Cover Page* will be requested (note that the Web form may request additional information):

- Alpha-numeric identifier of this NRA and full name of the NASA Research Announcement (note: these may already be included on the electronic form).
- Program name of this NRA (note: this may already be included on the electronic form).
- Name and full physical, institutional mailing address of the proposing Principal Investigator, telephone and facsimile numbers, and E-mail address.
- An open block for the PI signature and date on the printed hard copy.
- Full descriptive title of proposed investigation.
- Abbreviated title of proposed investigation (limited to 50 characters).
- NASA Grant or Contract Number of any current NASA award that the PI may hold that is a logical predecessor of the newly proposed work.
- Names, institutional affiliations, and E-mail addresses of any Co-Investigators (see definition of Personnel in Section 1.3; also note that all listed Co-I's must also be functionally identified in the proposal – see Section 3).
- Names, institutional affiliations, and E-mail addresses of any Collaborators (see definition of Personnel in Section 1.3).

- The physical mailing address, telephone number, and E-mail address of the office of sponsored programs at the proposing institution.
- Institutional endorsement, including the name and title of the Authorizing Official, name of proposing institution, and, for the hard copy submitted with proposal, a signature and date.
- Designation of the type of institution per the definitions in Section 1.2 above.
- A “Yes/No” indication whether an E/PO proposal is also submitted.
- The budget for any E/PO proposal that is submitted with the proposal both by year and for the total proposed period of performance.
- The costs for the proposed research task both by year and for the total proposed period of performance.

A block of space (≤ 2000 characters, including spaces, or about one-half page using the formats specified above) will be provided in the electronic *Cover Page/Proposal Summary* form for a self-contained *Proposal Summary* of the proposed research activity. Note that the electronic site is configured to allow this submission by “cut and paste” from any standard word processing software. The *Summary* provides background and perspective to the interested reader and, therefore, must include the following information:

- A description of the key, central objectives of the proposed research in terms sufficient for a nonspecialist not familiar with the document to grasp its essence and a statement of methods proposed to accomplish those proposed objectives;
- The perceived significance of the proposed work to NASA OSS interests; and
- If the proposal contains a Education/Public Outreach proposal, a two or three sentence summary of the intended activity.

Special conditions and instructions concerning the *Cover Page/Proposal Summary*:

1) Changes (such as whiteout or strikethrough) to the printed *Cover Page/Proposal Summary* are not permitted. Any needed changes to the information submitted electronically may only be made by editing the electronic submission by following the instructions of the Web page, after which the final *Cover Page/Proposal Summary* is then printed in order to secure the necessary signatures.

2) The authorizing institutional signature on the *Cover Page* certifies that the proposing institution has read and is in compliance with the three required certifications printed in full at the end of this Appendix; therefore, it is not necessary to separately submit these certifications with the proposal.

3) Electronic submission of a *Cover Page/Proposal Summary* does not satisfy the deadline for proposal submission. The required number of proposal copies, one with original signatures, must be received at the indicated address by the proposal due date.

4) NASA OSS is now publishing the names of the proposal, the PI, and the proposing institution, and the *Proposal Summary* of every selected investigation in a public data base (e.g., see <<http://www.hq.nasa.gov/office/oss/codesr/welcome.html>>). Therefore, the *Summary* should not include proprietary information that precludes its unrestricted release (see also Appendix B, (a)(2) and (c)(2)).

- *Summary of Personnel, Commitments, and Costs* (approximately 1 page)

The proposal must contain a 1-page summary list, in simple tabular form, that gives the names and intended work commitment for the PI and for every Co-I of the proposed investigation both in time (rounded to the nearest 0.01 of a Calendar Year) and unburdened salary (rounded to the nearest \$1K) for each year of the proposed period of performance (note: “unburdened” means without addition of overhead or fees). These entries of commitments should be shown separately for the research effort and for any proposed E/PO proposal. In addition, this list must contain the name(s) of any collaborator(s) associated with the proposal.

- *Scientific/Technical/Management Section* (approximately 10 pages)

This *Section* is the main body of a proposal and should cover the following topics in the order given, all within the specified page limit:

- The objectives and expected significance of the proposed research, including a complete description of any instruments or hardware proposed to be built in order to carry out the research (note: see also the *Facilities and Equipment* section below for the description of critical equipment needed for carrying out the proposed research);
- The perceived impact of the proposed work to the state of knowledge in the field and, if the proposal is a direct extension of an existing OSS award, how the proposed work is expected to build on and otherwise extend the previous accomplishments to date;
- The technical approach and methodology to be employed in conducting the proposed research, including any special facilities of the proposing institution(s) and/or capabilities of the proposer(s) for carrying out the work;
- The relevance of the proposed work to past, present, and/or future NASA OSS programs and interests or to the specific objectives given in this NRA;
- An outline of the general plan of work, including anticipated key milestones for accomplishments and the management structure for the personnel involved; and
- A statement of the expected contribution by the PI and each Co-I identified on the proposal, whether or not they derive support from the proposed budget (note: the inclusion of Co-I’s who are judged by peer review to have either insignificant or unjustified roles in a proposed program of research will be considered a weakness for purposes of the evaluation of the proposal).

The *Scientific/Technical/Management Section* may contain illustrations that amplify and demonstrate key points in the main text of the proposal (including milestone schedules, if appropriate). Any illustrations and figures must be of publication quality, of an easily viewed size, and have self-contained captions that do not contain critical information not provided elsewhere in the proposal.

- *References*

All citations given in the *Scientific/Technical/Management Section* must be included in a list of references, which should include the full title of the paper and/or book, as appropriate, and an easily understood abbreviation of the publication.

- *Facilities and Equipment*

As appropriate, this section should describe any facilities (including any U.S. Government owned facilities) and/or major equipment critical for carrying out the proposed project that are already available or would need to be purchased in order to carry out the proposed investigation. In the latter case, these costs should be entered in the required proposal *Budget Summary* and described in accompanying budget details.

- *Education and Public Outreach (E/PO) Proposal* (optional)

Proposals for E/PO efforts are strongly encouraged as an addition to any research proposal submitted in response to this NRA. The inclusion of an E/PO proposal of high merit increases the chance of selection if the “parent” research proposal is also of high scientific and technical merits, but the absence of an E/PO proposal, or the submission of one receiving a low evaluation score, does not prevent the selection of a parent research proposal of high merit. A Co-Investigator who will carry the prime responsibility for completing the E/PO work may be identified for this portion of the proposal (e.g., an appropriately qualified colleague from the PI institution or educational institution such as a public school district, museum, planetarium, etc.).

- *Curriculum Vitae*

The PI must submit a *Curriculum Vitae* (not to exceed 1 page) that includes his/her professional experiences, positions, and a bibliography of publications relevant to the proposal. The proposal must also include a 1-page *Vitae* for each key Co-I. A Co-I who serves as a Task or an Institutional PI (see section 1.3 above) may submit a *vitae* using the same page limit as for the PI. *Vitae* from Collaborators are not to be submitted.

- *Current and Pending Support*

Information must be provided for all ongoing and pending projects and proposals that involve the proposing PI and any Co-I’s who are either expected to perform a significant share of the proposed work (e.g., as a Task or as an Institutional PI (see section 1.3

above)), or who are proposed to receive support through the proposal. Therefore, for each of the two categories of support awards as may exist at the time of the proposal submission deadline, namely,

a) Current Support (for any of the period that overlaps with the proposal being submitted to this NRA) and

b) Pending Support (including the proposal to this NRA),
provide the following information for each such individual:

- Title of award or project;
- Program name (if appropriate) and sponsoring agency or institution (including point of contact);
- Proposed period of performance and budget; and
- Commitment by PI (or Co-I) in fractions of a full time Work Year (WY).

In addition, provide the name of any other institution, including point of contact with telephone number, to which the proposal submitted to this NRA, or any part thereof, has been or will be submitted for consideration of funding. For such pending research, the PI's must notify the relevant Program Executive immediately of any successful proposals that are awarded anytime after the proposal submission date until the time of selections.

• *Statement(s) of Commitment from Co-I's and/or Collaborators*

Every Co-I and Collaborator from a U.S. as well as a non-U.S. institution identified as a participant in the proposal must submit a brief, signed statement of commitment that acknowledges his/her participation even if they are from the PI's own institution. In the case of more than one Co-I and/or Collaborator, a single, multiply-signed statement is acceptable. Each statement should be addressed to the PI, may be a facsimile or E-mail, and must contain the following, or approximately similar, language:

“I(we) acknowledge that I(we) am(are) identified by name as Co-Investigator(s) [or Collaborator(s)] to the investigation entitled <name of proposal> that is submitted by <name of Principal Investigator> to the <name of Announcement> NASA Research Announcement, and that I(we) intend to carry out all responsibilities identified for me(us) in this proposal. I(we) understand that the extent and justification of my(our) participation as stated in this proposal will be evaluated during peer review in determining the merits of this proposal.”

- *Budget Summary and Details*

Proposals must contain a *Budget Summary* (format given at end of this Appendix) for each year of the proposed effort filled out in accordance with the following *Instructions for Budget Summary*. The Web site where this NRA is posted also has this form identified for downloading. Note especially the following important considerations:

(i) Attention is directed to discussion of item 2. *Equipment* on the *Instructions* sheet regarding the proposed purchase of personal computers and/or commercial software, both of which are considered to be “general purpose equipment.” If a proposal is selected for award, failure to adequately address the provisions of the instructions for item 2.c will require that NASA contact the proposing institution for the required information. Such activity may delay the award until the purchase is either justified as a direct charge for general purpose equipment or is budgeted as an indirect expense.

(ii) If a PI from a non-Government institution proposes to team with a Co-I from a U.S. Government institution (for this purpose, JPL is considered a NASA Center), then the institutional budget for that Government Co-I is to be included in the proposal’s *Budget Details*, and the cost for this Government Co-I is to be listed on line 4, “Other *Budget Summary*. If the proposal is selected, NASA will execute an inter- or intra-Agency funds transfer, as appropriate, to cover the cost of the Government Co-I. Conversely, if a Government PI institution teams with a private sector Co-I institution, that Government institution is expected to cover such Co-I costs through a subcontract that they execute. Therefore, such private sector Co-I costs should be entered on line 2.a, “Subcontracts,” on the *Budget Summary*.

(iii) The proposing (PI) institution must subcontract the funding of all proposal Co-I’s who reside at other institutions (except for a Government Co-I for a private sector PI as noted above) unless specifically noted otherwise in Appendix A; that is, NASA will not separately make awards to Co-I’s at distributed institutions regardless of the cost impact to the PI proposal for the management of such subcontracts.

(iv) In addition to the *Budget Summary* and in accordance with the *Instructions for Budget Summary* given in Section 6 of this Appendix, the proposing institution must append at the end of the proposal sufficient details in narrative format to allow a full understanding of the budget. The proposing institution may also append the proposed budget in the format of their choice without page limit.

(v) By 2000, NASA is expected to be operating on the basis of full cost accounting, including all Civil Service salaries with overhead. In the interim period, proposals involving NASA and JPL employees as either a PI or as a Co-I should use the accounting method authorized at their institutions at the time proposals are due and for the entire proposed period of performance.

(vi) If an Education/Public Outreach (E/PO) proposal is included with the research proposal, the budget numbers from the *E/PO Budget Summary* (see Appendix A) must be integrated with the corresponding budget categories on the *Budget Summary* for its “parent” Research Proposal given in Section 6 of this Appendix for the total period of performance, as well as for each individual year of the proposed effort.

- *Reprints/Preprints*

Unless otherwise specified in the Program Element in Appendix A, a maximum of two reprints and/or preprints for peer-reviewed publication that are considered critical to understanding the background of the proposal may be appended to the proposal. However, even if such items are appended, NASA’s peer reviewers are directed to base their judgments of the merits of the proposal only on its *Scientific/Technical/Management Section* and other related parts as described above in this section.

6. Forms and Certifications

The following pages contain:

- (a) the format and *Instructions* for the required proposal *Budget Summary* (note: a reasonable facsimile may be generated by the proposer for submission or the electronic form may be downloaded from the Web site that contains this NRA); and
- (b) copies of the three *Certifications* currently required by U.S. Code (note that these individual *Certifications* are included for reference only and should not be signed and returned; language is now included on the proposal *Cover Page* that confirms that these certification requirements are met once the printed copy of the *Cover Page* is signed by the Authorizing Institutional Representative and submitted with the proposal).

BUDGET SUMMARY for RESEARCH PROPOSAL

Includes optional Education/Public Outreach Proposal: _____YES_____NO

For (check one):

___ **Total Period of Performance from (M/D/Y)** _____ **to** _____

___ **For Year** ___ **of** ___ **from (M/D/Y)** _____ **to** _____

	<u> NASA USE ONLY </u>		
	A	B	C
1. <u>Direct Labor</u> (salaries, wages, and fringe benefits)	_____	_____	_____
2. <u>Other Direct Costs</u> :			
a. Subcontracts	_____	_____	_____
b. Consultants	_____	_____	_____
c. Equipment	_____	_____	_____
d. Supplies	_____	_____	_____
e. Travel	_____	_____	_____
f. Other	_____	_____	_____
3. <u>Facilities and Administrative Costs</u>	_____	_____	_____
4. <u>Other Applicable Costs</u> :	_____	_____	_____
5. <u>SUBTOTAL--Estimated Costs</u>	_____	_____	_____
6. <u>Less Proposed Cost Sharing</u> (if any)	_____	_____	_____
7. <u>Carryover Funds</u> (if any)			
a. Anticipated amount : _____			
b. Amount used to reduce budget	_____	_____	_____
8. <u>Total Estimated Costs</u>	_____	_____	XXXXXXXX
9. APPROVED BUDGET	XXXXXX	XXXXXX	_____

INSTRUCTIONS FOR BUDGET SUMMARY

- Provide a complete Budget Summary (which may include an optional Education/Public Outreach effort) for the total as well as each individual year of the proposed period of performance.
 - Enter the proposed estimated costs in Column A (Columns B & C for NASA use only).
 - Provide, as attachments, detailed computations of all estimates in each cost category with narratives as required to fully explain each proposed cost as follows.
1. Direct Labor (salaries, wages, and fringe benefits): Attachments should list the number and titles of personnel, amounts of time to be devoted to the grant, and rates of pay.
 2. Other Direct Costs:
 - a. Subcontracts: Attachments should describe the work to be subcontracted, estimated amount, recipient (if known), and the reason for subcontracting.
 - b. Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
 - c. Equipment: List separately. Explain the need for items costing more than \$5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested to be made as a direct charge under this award must include the equipment description, how it will be used in the conduct of the basic research proposed and why it cannot be purchased with indirect funds.
 - d. Supplies: Provide general categories of needed supplies, the method of acquisition, and the estimated cost.
 - e. Travel: Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
 - f. Other: Enter the total of direct costs not covered by 2a through 2e. Attach an itemized list explaining the need for each item and the basis for the estimate.
 3. Facilities and Administrative (F&A) Costs: Identify F&A cost rate(s) and base(s) as approved by the cognizant Federal agency, including the effective period of the rate. Provide the name, address, and telephone number of the Federal agency official having cognizance. If unapproved rates are used, explain why, and include the computational basis for the indirect expense pool and corresponding allocation base for each rate.
 4. Other Applicable Costs: Enter total explaining the need for each item.
 5. Subtotal-Estimated Costs: Enter the sum of items 1 through 4.
 6. Less Proposed Cost Sharing (if any): Enter any amount proposed. If cost sharing is based on specific cost items, identify each item and amount in an attachment.

7. Carryover Funds (if any): Enter the dollar amount of any funds expected to be available for carryover from the prior budget period. Identify how the funds will be used if they are not used to reduce the budget. NASA officials will decide whether to use all or part of the anticipated carryover to reduce the budget (not applicable to 2nd-year and subsequent-year budgets submitted for award of a multiple year award).
8. Total Estimated Costs: Enter the total after subtracting items 6 and 7b from item 5.

**Certification Regarding Debarment, Suspension, and
Other Responsibility Matters**

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 34 CFR Part 85, Section 85.510, Participant's responsibilities. The regulations were published as Part VII of the May 26, 1988 Federal Register (pages 19160-19211).

1. The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:
 - (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
 - (b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
 - (c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and
 - (d) Have not within three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.
2. Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Certification Regarding Lobbying

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000 for each such failure.

**Certification of Compliance with the NASA Regulations Pursuant to
Nondiscrimination in Federally Assisted Programs**

The (*Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant "*) hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S. 794), and the Age Discrimination Act of 1975 (42 U.S. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

This assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.